Omaha Public Power District
1623 Harney Omaha, Nebraska 68102
402/536 4000

February 24, 1984
LIC-84-057

Mr. James R. Miller, Chief
U. S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Division of Licensing
Operating Reactors Branch No. 3
Washington, D.C. 20555

Reference: Docket No. 50-285

Dear Mr. Miller:

Statistical Combination of Uncertainties Report
Fort Calhoun Station Unit No. 1

Pursuant to discussions held with Mr. E. G. Tourigny of your staff on February 10 and February 14, 1984 and in response to your letter dated February 13, 1984, the attached information is provided in regard to your request for additional information concerning the above subject. Attachment A reflects the proprietary version and Attachment B reflects the non-proprietary version.

Please note that pursuant to 10 CFR 2.790(b)(1), certain portions of the attached information has been deemed trade secrets and/or privileged commercial information by Combustion Engineering, Inc. (CE). Accordingly, please find attached the District's application for withholding this information from public disclosure, as well as CE's affidavit in support of the application.

Sincerely,

W. C. Jones
Division Manager
Production Operations

WCJ/JJF:jmm

Attachment

cc: LeBoeuf, Lamb, Leiby & MacRae
1333 New Hampshire Avenue, N.W.
Washington, D.C. 20036

Mr. E. G. Tourigny, Project Manager
Mr. L. A. Yandell, Senior Resident Inspector

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BEFORE THE UNITED STATES

NUCLEAR REGULATORY COMMISSION

In the Matter of)

OMAHA PUBLIC POWER DISTRICT) Docket No. 50-285
(Fort Calhoun Station,)
Unit No. 1))

APPLICATION FOR WITHHOLDING INFORMATION FROM PUBLIC DISCLOSURE

Pursuant to Section 2.790(b)(1) of the regulations of the Nuclear Regulatory Commission ("the Commission"), Omaha Public Power District ("the District") submits this application to withhold certain information from public disclosure. Applicant has been informed by Combustion Engineering, Inc. (CE) that this information is owned by CE and that in the opinion of CE the information in question contains trade secrets and/or privileged or confidential commercial or financial information.

An attached affidavit executed by CE identifies the documents sought to be withheld and sets forth the bases on which the information may be withheld from public disclosure by the Commission. The affidavit also addresses the considerations listed in Paragraph (b)(4) of Section 2.790 with specificity.

Respectfully submitted,

OMAHA PUBLIC POWER DISTRICT

By ____________________
W. C. Jones
Division Manager
Production Operations

Sworn to before me this

27 day of February, 1984.

____
Notary Public

GENERAL NOTARY - State of Nebraska
JAMES J. [illegible]
My Comm. Exp. [illegible]

AFFIDAVIT PURSUANT

TO 10 CFR 2.790

Combustion Engineering, Inc.)
State of Connecticut)
County of Hartford) SS.:

I, A. E. Scherer, depose and say that I am the Director, Nuclear Licensing, of Combustion Engineering, Inc., duly authorized to make this affidavit, and have reviewed or caused to have reviewed the information which is identified as proprietary and referenced in the paragraph immediately below. I am submitting this affidavit in conformance with the provisions of 10 CFR 2.790 of the Commission's regulations and in conjunction with the application of Omaha Public Power District for withholding this information.

The information for which proprietary treatment is sought is contained in the following document:

Attachment to OPPD Letter LIC-84-057 dated February 24, 1984, from W. C. Jones (OPPD) to J. Miller (USNRC).

This document has been appropriately designated as proprietary.

I have personal knowledge of the criteria and procedures utilized by Combustion Engineering in designating information as a trade secret, privileged or as confidential commercial or financial information.

Pursuant to the provisions of paragraph (b) (4) of Section 2.790 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure, included in the above referenced document, should be withheld.

1. The information sought to be withheld from public disclosure are methods of developing uncertainty distributions, limiting values of net uncertainties and setpoints of technical specifications for OPPD's Fort Calhoun reactor, which is owned and has been held in confidence by Combustion Engineering.

2. The information consists of test data or other similar data concerning a process, method or component, the application of which results in a substantial competitive advantage to Combustion Engineering.

3. The information is of a type customarily held in confidence by Combustion Engineering and not customarily disclosed to the public. Combustion Engineering has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The details of the aforementioned system were provided to the Nuclear Regulatory Commission via letter DP-537 from F.M. Stern to Frank Schroeder dated December 2, 1974. This system was applied in determining that the subject document herein are proprietary.

4. The information is being transmitted to the Commission in confidence under the provisions of 10 CFR 2.790 with the understanding that it is to be received in confidence by the Commission.

5. The information, to the best of my knowledge and belief, is not available in public sources, and any disclosure to third parties has been made pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence.

6. Public disclosure of the information is likely to cause substantial harm to the competitive position of Combustion Engineering because:

a. A similar product is manufactured and sold by major pressurized water reactor competitors of Combustion Engineering.

b. Development of this information by C-E required thousands of manhours of effort and hundreds of thousands of dollars. To the best of my knowledge and belief a competitor would have to undergo similar expense in generating equivalent information.

c. In order to acquire such information, a competitor would also require considerable time and inconvenience related to the methodology development and calculation of net uncertainties and setpoints of technical specifications for OPPD's Fort Calhoun reactor.

d. The information required significant effort and expense to obtain the licensing approvals necessary for application of the information. Avoidance of this expense would decrease a competitor's cost in applying the information and marketing the product to which the information is applicable.

e. The information consists of methods of developing uncertainty distributions, limiting values of net uncertainties and setpoints of technical specifications for OPPD's Fort Calhoun reactor, the application of which provides a competitive economic advantage. The availability of such information to competitors would enable them to modify their product to better compete with Combustion Engineering, take marketing or other actions to improve their product's position or impair the position of Combustion Engineering's product, and avoid developing similar data and analyses in support of their processes, methods or apparatus.

f. In pricing Combustion Engineering's products and services, significant research, development, engineering, analytical, manufacturing, licensing, quality assurance and other costs and expenses must be included. The ability of Combustion Engineering's competitors to utilize such information without similar expenditure of resources may enable them to sell at prices reflecting significantly lower costs.

g. Use of the information by competitors in the international marketplace would increase their ability to market nuclear steam supply systems by reducing the costs associated with their technology development. In addition, disclosure would have an adverse economic impact on Combustion Engineering's potential for obtaining or maintaining foreign licensees.

Further the deponent sayeth not.

A. E. Scherer
Director
Nuclear Licensing

Sworn to before me
this 23rd day of February, 1984

Notary Public
THERESA M. REGAN, NOTARY PUBLIC
STATE OF CONNECTICUT NO. 6[illegible]7
COMMISSION EXPIRES MARCH 31, 1988

ATTACHMENT B

NON-PROPRIETARY VERSION

PROPRIETARY INFORMATION HAS BEEN
REMOVED FROM BRACKETS ([ ])

ATTACHMENT

NRC Question: Section 2.2 of Part 1 of the report indicates that the minor changes in the analytical technique (used to evaluate the uncertainty factors for other CE plants employing analog reactor protection systems) have been made to accommodate the earlier generation RPS in use at Fort Calhoun. (a) What are the differences between the Fort Calhoun RPS and that used in Calvert Cliffs and St. Lucie? (b) What are the changes in the analytical technique to accommodate the differences? (c) What are the differences between the CESCU stochastic simulation methodology and that used for Calvert Cliffs and St. Lucie?

Response: **Part (a)**

There are four important differences between the Fort Calhoun RPS and that used in the Calvert Cliffs and St. Lucie units. These differences are as follows:

1. The TM/LP trip at the Calvert Cliffs and St. Lucie units uses the following equation:

$$P_{var} = \alpha \cdot A1 \cdot QR1 + \beta T_{in} + \gamma$$

where

P_{var} = variable low pressure trip limit.
A1 = a function of measured ex-core ASI (see Figure 1).
QR1 = a function of measured core power (see Figure 2).
T_{in} = measured coolant inlet temperature.
α, β and γ = preset constants.

The TM/LP trip at Fort Calhoun uses the following equation:

$$P_{var} = \alpha \cdot PF(Q) \cdot \beta T_{in} + \gamma$$

where all terms are the same as in the previous equation except for:

Q = measured core power, and
PF(Q) = a function of core power (see Figure 3).

As noted from these equations, the Fort Calhoun TM/LP trip setpoint is not compensated for changes in ASI.

2. The LHR trips at Fort Calhoun and Calvert Cliffs are called the Axial Power Distribution Trips (Early System). It monitors core power and ASI as illustrated in Figure 4. The St. Lucie LHR trip is called the Local Power Density Trip (standard system). The system pro-

cesses the parameters of core power and ASI in [illegible] provide the flexibility of programming [illegible] functions (see Figures 5 and 6). As shown [illegible] QR2 vs. Power function is generally [illegible]

3. The Calvert Cliffs and St. Lucie delta-T power calculator are characterized by the following equation:

$$\Delta T \text{ Power} = \underbrace{K_\alpha \Delta T + K_\beta \Delta T (T_c - 427.5) + K_\gamma \Delta T^2}_{\text{static term}} + \underbrace{\tau\, d/dt\, ([illegible])}_{\text{dynamic compensation term}}$$

where

T_c	=	measured cold leg temperature,
T_h	=	measured hot leg temperature,
ΔT	=	$T_h - T_c$
427.5	=	reference temperature for RTDs,
K_α, K_β and K_γ	=	constants for static delta-T power,
τ and a	=	constants for dynamic compensation term, and
t	=	time

The Fort Calhoun system does not contain dynamic compensation.

4. The Fort Calhoun and Calvert Cliffs Power Ratio Signal Calculator (PRSC) compare the measured ex-core ASI with the allowed ASI band as determined from the excore DNB or LHR LCO tents. The allowed ASI band for a given power level is dialed into the system. The dialed setpoints change as a function of power level.

The St. Lucie PRCS automatically calculates the allowed ASI band. The breakpoints determining the LCO tents are programmed into this system.

Part (b)

There are no changes in the Monte Carlo simulation technique used to perform the analysis at Fort Calhoun. It is the same as that used for Calvert Cliffs and St. Lucie. The only changes are in the input description of uncertainties. The Calvert Cliffs TM/LP analysis (DNB LSSS) requires only one electronic processing uncertainty since axial shape index is an input to the trip function. At Fort Calhoun ASI is not input to the TM/LP trip function, but appropriate ASI limits are enforced by the LCO specification. For Fort Calhoun, therefore, two electronic processing uncertainty terms are required for the DNB LSSS: the TM/LP trip uncertainty and the ASI monitoring uncertainty.

Part (c)

The differences between the CESCU stochastic simulation methodology and that used earlier at Calvert Cliffs and St. Lucie are minor. The CETOP code version used in the earlier SCU analyses has been superseded by the CETOP-D code now used by CE in core thermal design. CESCU now uses the CETOP-D code for all DNB evaluations. In addition, minor changes were made in CESCU to accommodate changes in CE's computing system and to automate certain file handling. The overall analysis sequence and statistical algorithms are identical to that employed in earlier SCU analyses.

NRC Question: How are the uncertainty components combined to derive the SMLS (APD LSSS) and SMDS (DNB LSSS). What are the sensitivity factors applied to these pertinent uncertainty components

Response: The overall LSSS uncertainty factors (SMLS, SMDS) are the result of the combination of individual uncertainty components by the Monte Carlo simulation systems described in Section 2 and Appendix A of Part 1. The sensitivity factors are implicit in the models used in the overall simulation.

NRC Question: The [ ] and the shape annealing uncertainty is proportional to the [ ] as shown in Tables B1-1 to B1-3. What are the values of these uncertainties used in arriving at the SMLS and SMDS values?

Response: The SCU analysis uses a selection of power shapes which are representative of those obtained in the shape analysis procedure for plant setpoint determination. These shapes cover a range of core average ASI's from -0.4 to +0.4. These core average ASI's are converted to peripheral ASI's by the [ ] in equation B1-12. Since the uncertainty in shape annealing is proportional [ ], the [ ] is used corresponding to the [ ]. This is used only in the SCU analysis and produces the [ ] on shape annealing uncertainty. This is conservative for [ ] cases.

NRC Question: Tables 3-1 and B1-1 show a monitoring system processing uncertainty of [ ]. Appendix B3 also provides a general description of calculating the processing uncertainty. (a) What are the process variables and their uncertainty values considered in obtaining the overall processing uncertainty of [ ]? (b) Why is the value so small compared to [ ] for Calvert Cliffs and [ ] shown in Table 3-2? (c) Why are the coolant inlet temperature and RCS pressure uncertainties different between Tables 3-1 and 3-2?

Response: The ASI processing uncertainty represents a bounding value of the uncertainty introduced by the electronics and equipment associated with the Reactor Protection and Monitoring Systems. This uncertainty accounts for the errors in component tolerances and calibrations in the RPS equipment but does not include process instrument ... considered elsewhere. The Fort Calhoun ... than that employed at Calvert Cliffs and St. Lucie ... component and calibration points. The result ... certainty due to these components. This does not ... the Fort Calhoun RPS is more accurate than the Calvert Cliffs and St. Lucie systems, but simply that it has a lower ... tainty for use in SCU.

The uncertainties in Table 3-2 represent the previous uncertainties used in deterministic evaluations. As part of the SCU program, uncertainties were evaluated more rigorously to provide accurate inputs to the Monte Carlo simulations. These values are provided in Table 3-1.

NRC Question: Table 3-1 indicates that the penalty for rod bow up to 50,000 MWD/MTU is included in the uncertainty of [ ] for power peaking factor. What is the value for rod bow penalty?

Response: The original SCU reports for Calvert Cliffs and St. Lucie were issued prior to NRC approval of the CE Rod Bow topical (CENPD-225-P-A) and the INCA/CECOR Power Peaking Uncertainty Topical (CENPD-153-P, Revision 1-P-A). Interim values were used for power peaking uncertainties. Now, both topicals are approved. Therefore, a combined power peaking uncertainty is used which combines the uncertainty in peaking due to rod bow with the <u>CECOR</u> peaking factor uncertainty. The rod bow uncertainty is calculated using the methods in CENPD-225 for 50,000 MWD/MTU and 4.1 w/o enrichments. This results in an uncertainty with a mean value of [ ] and a standard deviation of [ ] applied to both F_q and F_r.

The CECOR uncertainties have a standard deviation of [ ] and a mean of [ ] for F_q and [ ] for F_r. Combining the uncertainties gives a standard deviation of [ ] and a mean of [ ] for F_r and a mean of [ ] for F_q. The 95/95 value of the uncertainty is [ ]. The simulation uses the mean and standard deviation values to describe the peaking factor uncertainty distribution; the 95/95 value is provided for comparison purposes here.

NRC Question: How is the transient power decalibration (TPD) allowance obtained?

Response: The transient power decalibration (TPD) is an allowance and not an uncertainty. Therefore, generation of the value is not included in the SCU topical. It is defined in CENPD-199-P, Revision 1-P, and is accounted for in the Fort Calhoun ... load analysis.

NRC Question:

a. In the TM/LP pressure LSSS limit calculation, why is it that the TPD is [ ] the core power to obtain B^{LSSS}_{DNB} in Equation 3-7?

b. Why are the power measurement uncertainties ... temperature measurement uncertainties (TMU) [ ] the power and input temperature (Equations ... and C-8) for the low pressure limit calculations?

Response: The discussions in Section [illegible] of Part [illegible] in Appendix [illegible] of Part 1, and in Appendix [illegible] of Part 3 attempts to show the differences between how the statistically combined uncertainties and the deterministically [illegible] uncertainties were incorporated into the development of the setpoints via the [ ] discussed in CE's Setpoint Topical, CENPD-199-P, Rev. 1-P. The specific equations of Section 3 and these appendices represent a shorthand summary of the end results of the Setpoint Topical [ ].

The uncertainties described in all of these discussions are accounted for before the limits are obtained. The plant's protective system does not incorporate these uncertainties directly. Rather, the protection system's setpoints are compared with the conservatively defined limits.

Thus, TPD, BMU, and TMU are [ ] to provide conservatively generated setpoints for the protective system output to be compared to.

NRC Question:

a. Is there an error in equation B1-12? Should the [ ] not be included?

b. Are Figures 2-1 and 2-2 reversed?

c. Is the second term in Equation A-13 ΔB_{OPM}?

d. Should the equation B2-2 be as follows: $\Delta Pwr = (2))\partial pwr/\partial mfw) \Delta Mf_w)^2 + \ldots$?

Response: (a), (b), (c), (d). Yes. See Errata Sheet 1, attached, for the correction of these errors and others which were uncovered during the review of the SCU reports prompted by this series of questions.

NRC Question: Table A-1 of Part 3 report shows the ASI processing uncertainty of [ ] psia for the DNB LCO, which is incorrect. What is the correct value?

Response: The correct value for the ASI processing uncertainty should be [ ] for the DNB LCO, as indicated in Errata Sheet 2, attached.

FIGURE 1

TYPICAL A_1 FUNCTION FOR THE STANDARD TM/LP TRIP SYSTEM

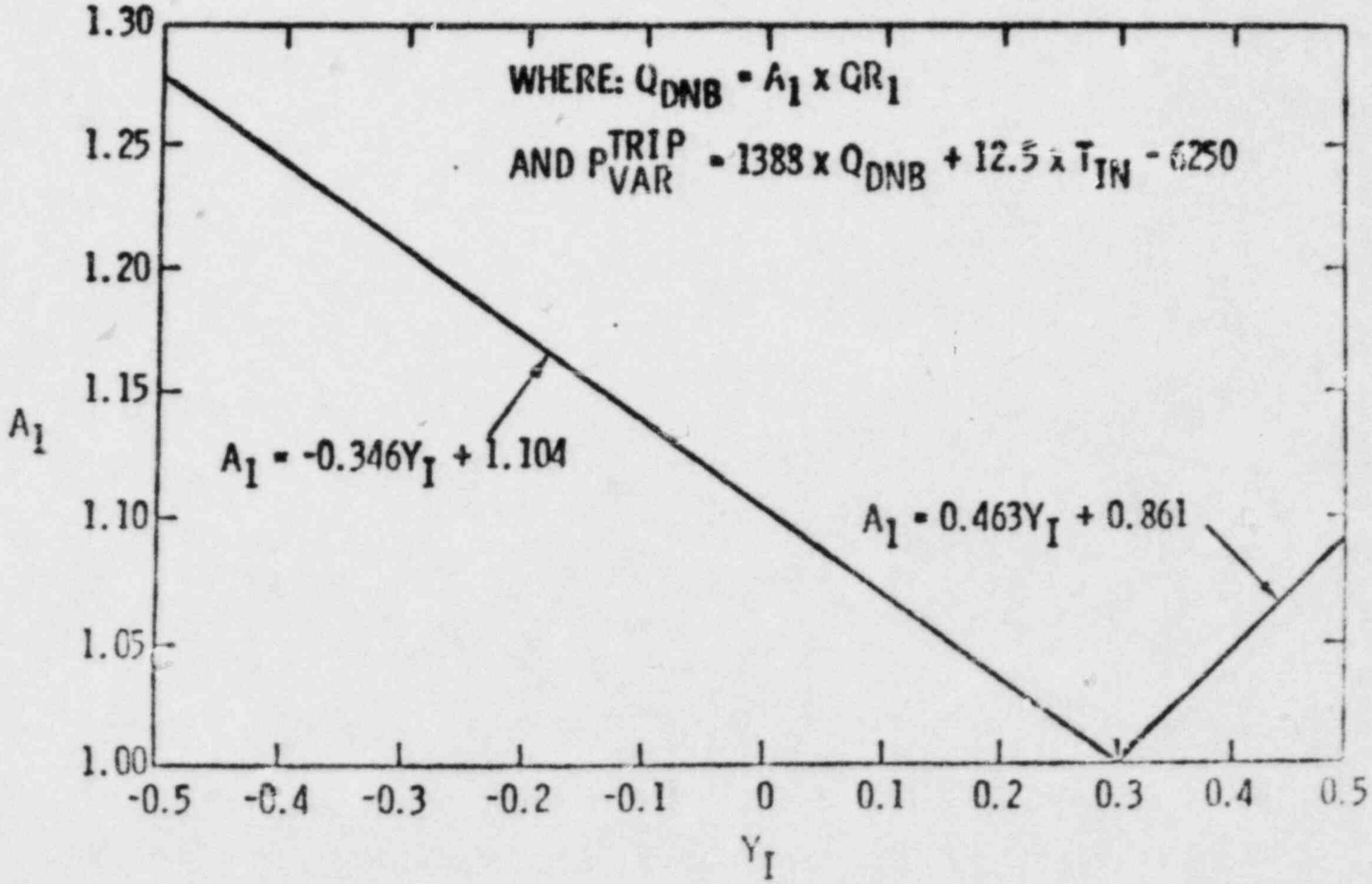


FIGURE 2

TYPICAL QR1 FUNCTION FOR
STANDARD TM/LP TRIP SYSTEM

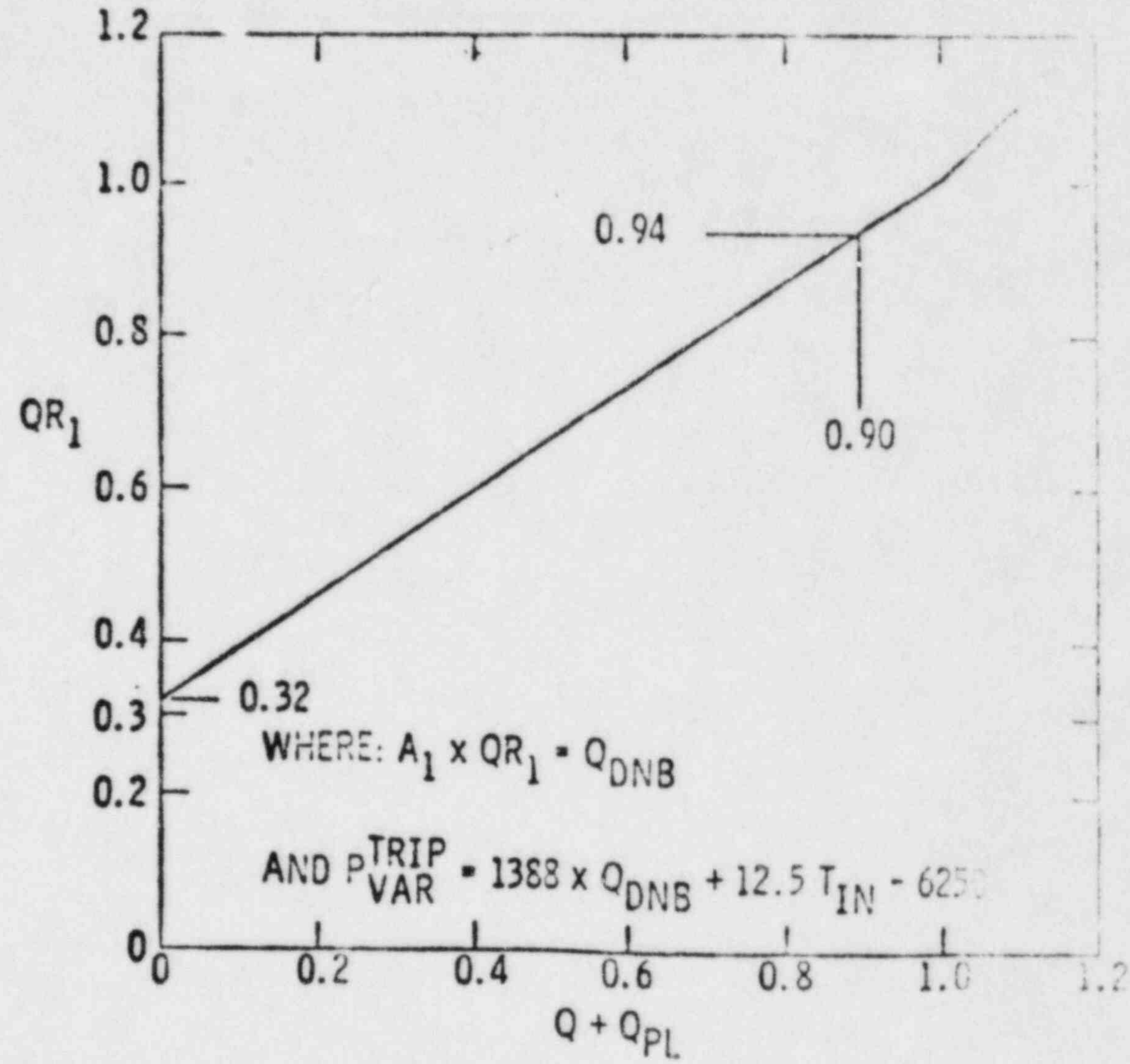


FIGURE 3

TYPICAL PF(Q) FUNCTION FOR THE EARLY TM/LP TRIP SYSTEMS

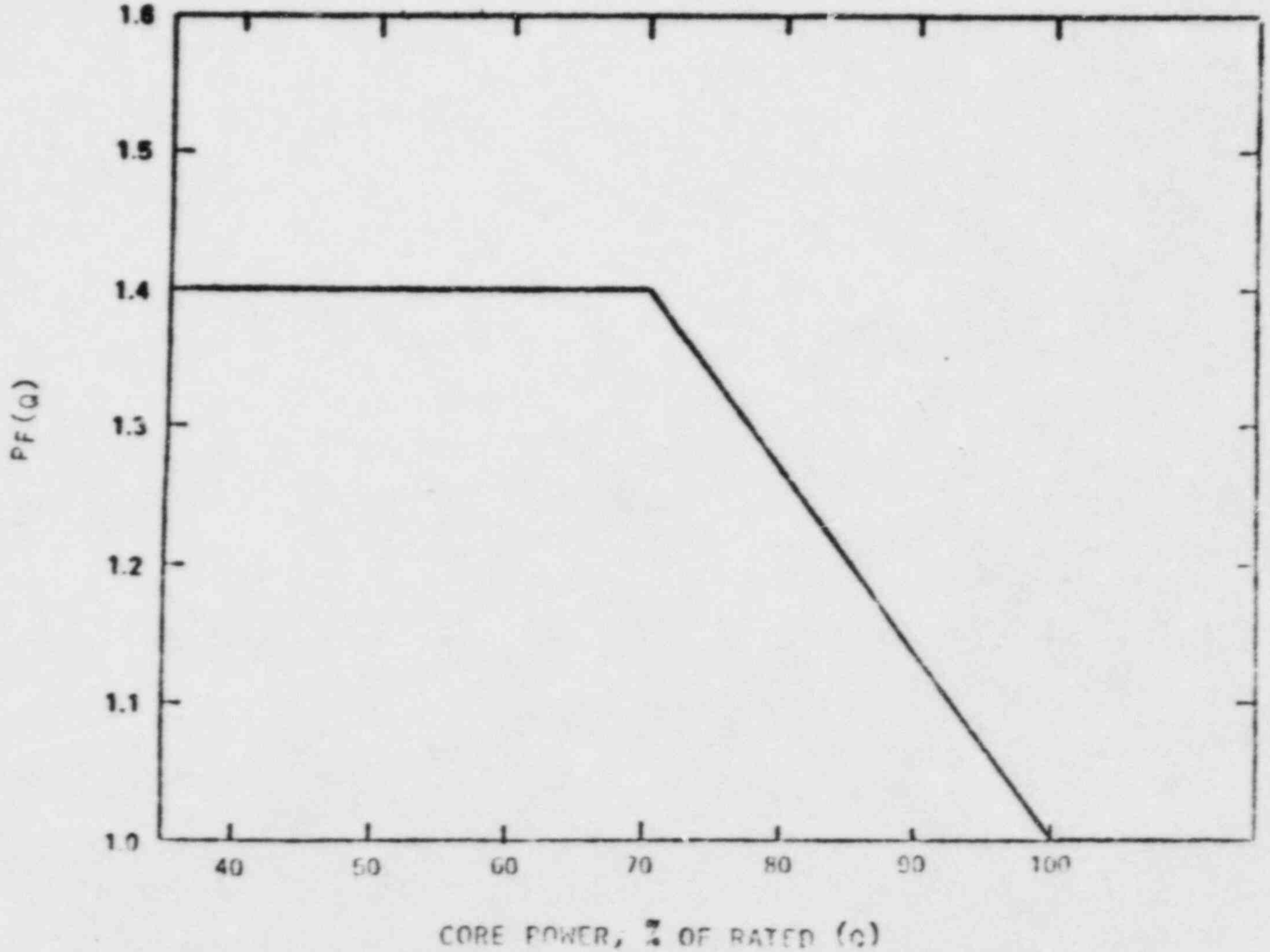


FIGURE 4

TYPICAL LHR LSSS
FOR THE EARLY SYSTEM

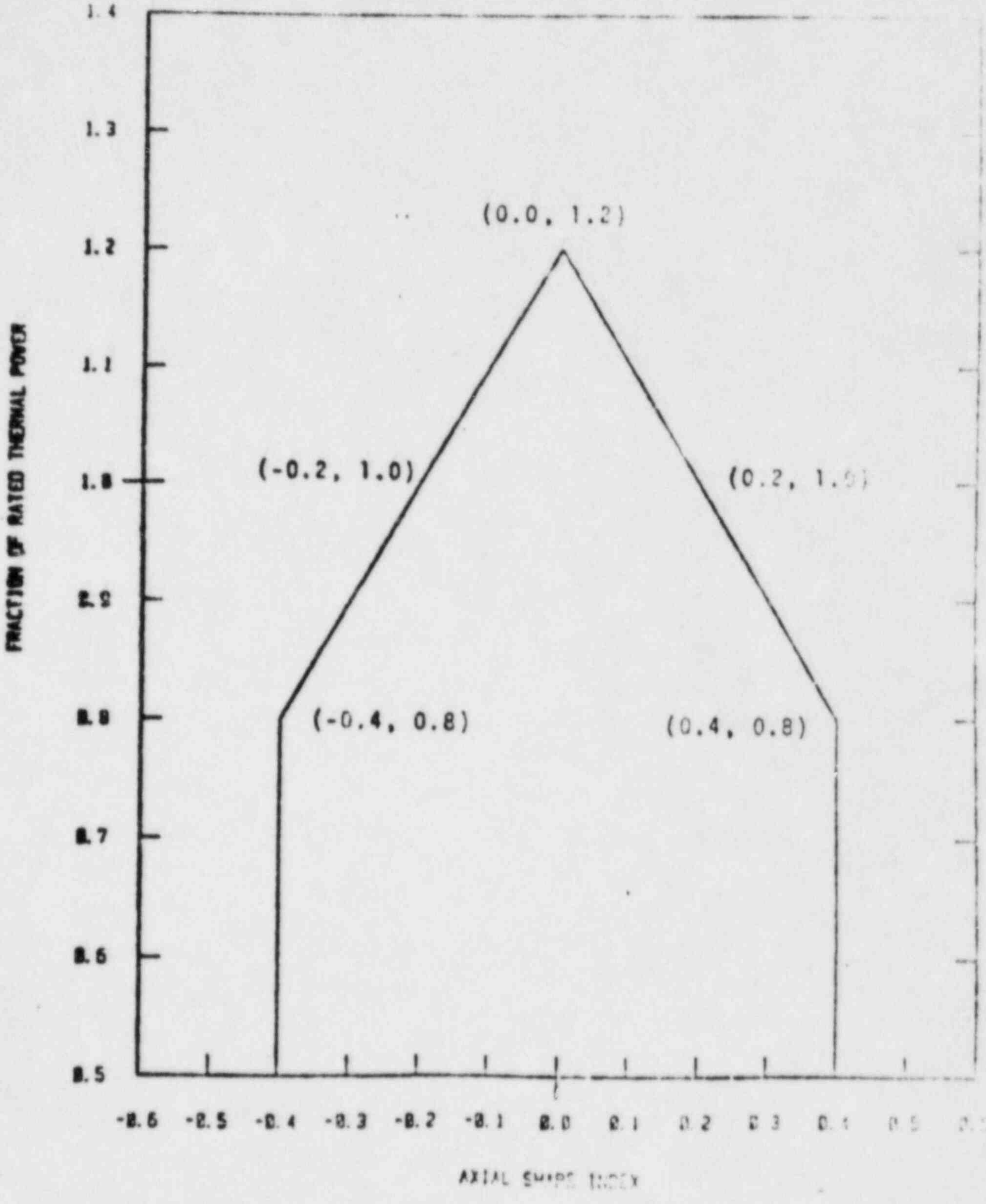


FIGURE 5

TYPICAL LHR LSSS
FOR THE STANDARD SYSTEM
(QR_2 VS. CORE POWER)

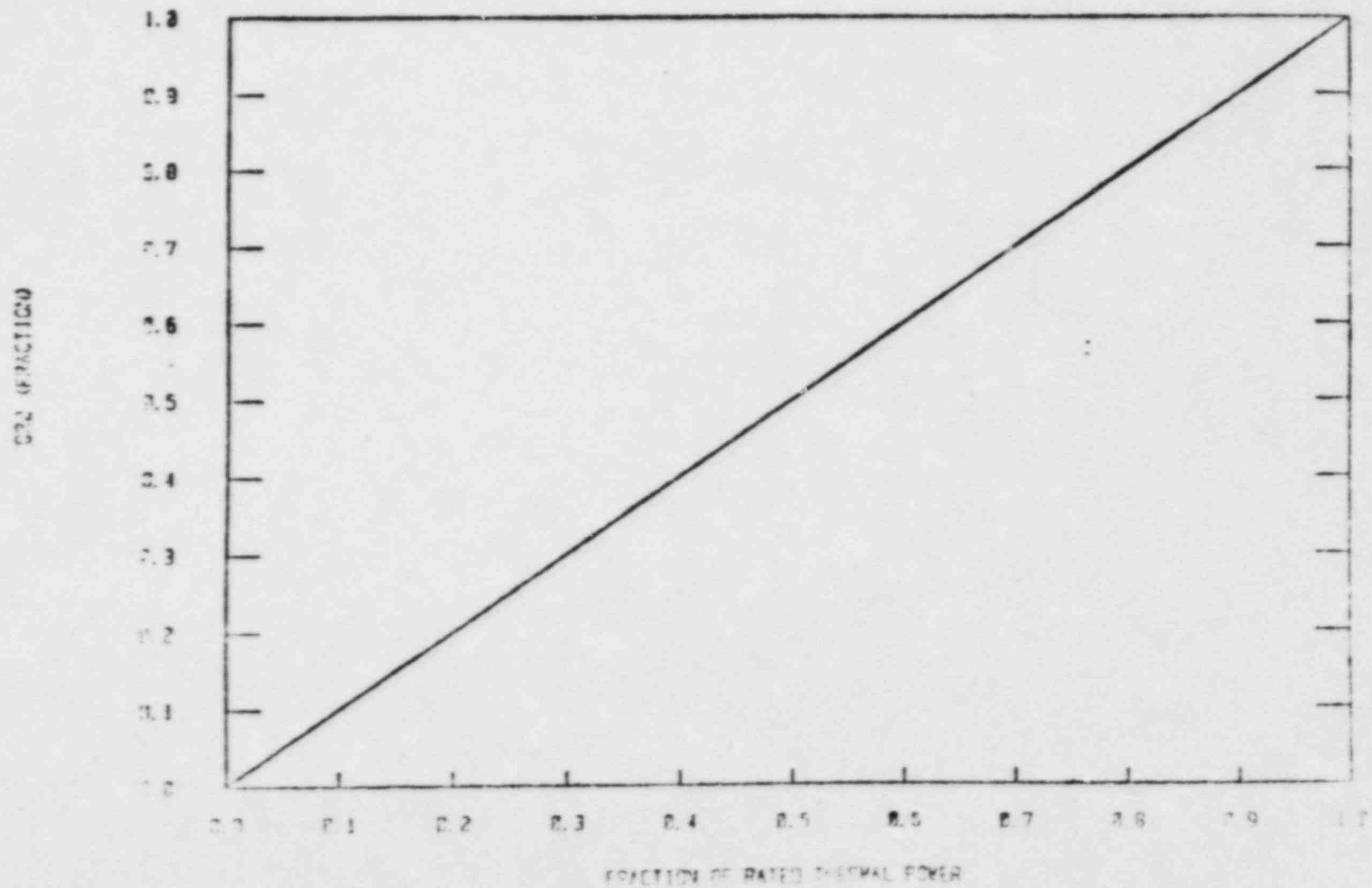
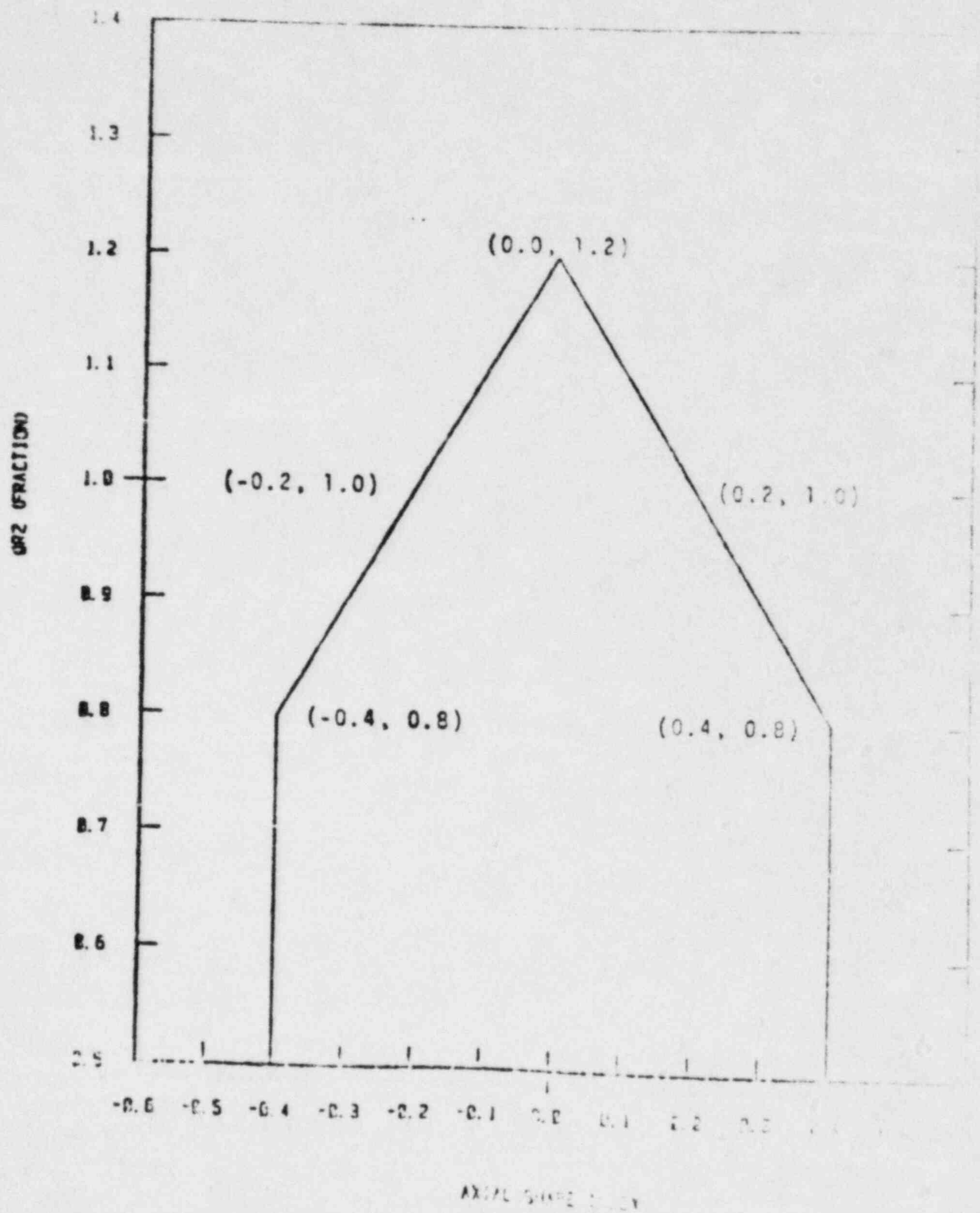


FIGURE [illegible]

TYPICAL [illegible]

THE STANDARD [illegible]

(QR_2 VS. ASI)



Errata Sheet 1

For CEN-257(O)-P, Part 1

Page 2-5 Change Figure Number from "2-1" to "2-2"

Page 2-6 Change Figure Number from "2-2" to "2-1"

Page 3-2 Change Equation 3-3

from "$\left[B_{opm} = \frac{P_{fdn}}{(1+SMDS)} - TPD \right]$" to "$\left[B_{opm} = \frac{P_{fdn}}{(1+SMDS)} \right]$"

Page 3-5 Change Table 3-1

from	"core coolant inlet temperature (^{o}F)	NA	[$\pm$9.5***]"
to	"core coolant inlet temperature (^{o}F)	NA	[$\pm$0.5***]"

Page A-6 Change Equation A-13

from "[$B_{opm} = P_{fdn_k} + B_{opm_k} + BNU_k$]"

to "[$B_{opm_k} = P_{fdn_k} + \Delta B_{opm_k} + BNU_k$]"

And the note to Equation A-13

from "[B_{opm_k} = Sampled Overpower uncertainty due to ASI uncertainty]"

from "[ΔB_{opm_k} = sampled overpower uncertainty due to ASI uncertainty]"

Page B-13 Change Equation (B1-12)

from "[$I_p^C = \overline{I}^Q(r) + \mu^C + \mu^R$ (B1-12)]"

to "[$I_p^C = \overline{I}^Q + \mu^Q(r) + \mu^C + \mu^R$ (B1-12)]"

Page B-[illegible] Change Equation B2-2

from

$$\text{"PWR} = \left(2((Pwr/Mfw)\ Mfw)^2 + 2((Pwr/Tfw)\ Tfw)^2 + 2((Pwr/Pfw)\ Pfw)^2 + 2((Pwr/Psec)\ Psec)^2 + ((Pwr/P1)\ B1)^2 + ((Pwr/Qpar)\ Qpzr)^2 + 4((Pwr/Qp)\ QP)^2 + 2((Pwr/Mbd)\ Mbd)^2 + 2((Pwr/Tbd)\ Tbd)^2\right)^{1/2}\text{"}$$

to

$$\text{"PWR} = \left(2\left\{\left(\frac{\partial Pwr}{\partial Mfw}\right)\Delta Mfw\right\}^2 + 2\left\{\left(\frac{\partial Pwr}{\partial Tfw}\right)\Delta Tfw\right\}^2 + 2\left\{\left(\frac{\partial Pwr}{\partial Pfw}\right)\Delta Pfw\right\}^2 + 2\left\{\left(\frac{\partial Pwr}{\partial Psec}\right)\Delta Psec\right\}^2 + \left\{\left(\frac{\partial Pwr}{\partial B1}\right)\Delta B1\right\}^2 + 2\left\{\left(\frac{\partial Pwr}{\partial Qpzr}\right)\Delta Qpzr\right\}^2 + 4\left\{\left(\frac{\partial Pwr}{\partial Qp}\right)\Delta Qp\right\}^2 + 2\left\{\left(\frac{\partial Pwr}{\partial Mbd}\right)\Delta Mbd\right\}^2 + 2\left\{\left(\frac{\partial Pwr}{\partial Tbd}\right)\Delta Tbd\right\}^2\right)^{1/2}\text{"}$$

Page C-3 **Change Equation C-3**

from

$$\text{"}\left[B_{opm} = \frac{P_{fdn}}{(1+Taz)(1+PU)} - BMU\right]\text{"}$$

to

$$\text{"}\left[B_{opm} = \frac{P_{fdn}}{(1+Taz)(1+PU)}\right]\text{"}$$

Errata Sheet 2

For CEN-257(O)-P, Part 3

Page 2-5 Change Equation 2-2

from "[$B_{opm} = P_{fdn_k} + B_{opm_k} + BMU_k$]"

to "[$B_{opm_k} = P_{fdn_k} + \Delta B_{opm_k} + BMU_k$]" .

And the note to Equation 2-2

from "[B_{opm_k} = Sampled overpower uncertainty due to ASI uncertainty]"

to "[ΔB_{opm_k} = Sampled overpower uncertainty due to ASI uncertainty]"

Page A-3 Change Processing Uncertainty(n)

from "DNB (psia) [$\pm$.012(5) - 0.0]"

to "DNB (asiu) [$\pm$.012(5) - 0.0]"

Page B-3 Change Equation B-4

from "$$\left[D_{DNB}^{LCO} = \frac{P_{fdn}}{(1+Taz)_{(1+PU)}} - BMU \right]$$"

to "$$\left[D_{DNB}^{LCO} = \frac{P_{fdn}}{(1+Taz)(1+PU)(ROPM)} - BMU \right]$$"